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Institutional Readiness to Implement the Enhanced Transparency Framework: **Is India Ready?**

WORKING PAPER | AUGUST 2019

Vani Rijhwani



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ACKNOWLEDGEMENTS:

My sincere thanks to Mr RR Rashmi, Ms Neha Pahuja, Mr Karan Mangotra and Mr Abhishek Kaushik for their continuous guidance and knowledge sharing.

Designed by

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SUPPORTED BY:

This work was supported by Shakti Sustainable Energy Foundation under its assistance for interpreting the Transparency Framework under the Paris Agreement and its Implications for India. TERI is grateful to Shakti Sustainable Energy Foundation for their support.

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SUGGESTED FORMAT FOR CITATION:

Rijhwani, Vani (2019) Institutional Readiness to Implement the Enhanced Transparency Framework: Is India Ready?. TERI, Working Paper (New Delhi: The Energy and Resources Institute)

PUBLISHED BY:

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Institutional Readiness to Implement the Enhanced Transparency Framework: Is India Ready?

Abstract

Institutional Readiness or the preparedness to respond to emerging needs and adapt to new ways of doing things determines to a great extent how effectively institutions can deliver with mixed support of robust processes, adequate human resources and technological capacities. One of the key elements of the Katowice Package (2018) was the adoption of Enhanced Transparency Framework (ETF). This entails guidelines, rules and procedures that will make it possible to track the progress made by each country on its nationally determined contribution (NDC) goals. The implementation of ETF calls for streamlining domestic institutions for better reporting of mitigation efforts. While there are many elements of the framework that needs to be built, there exists scope and time for developing Parties like India for building domestic reporting mechanisms and aligning their domestic institutions for improved transparency over time. The aim of this working paper is to unpack the Modalities, Procedures and Guidelines (MPGs) of ETF and assess institutional readiness in India for preparing its national communications so as to effectively implement the ETF.

1. INTRODUCTION

Since 1992, the idea of *transparency* for reporting and reviewing information on the climate policies and measures taken by Parties has emerged as one of the key elements gaining much attention and weightage under the *United Nations Framework Convention on Climate Change* (UNFCCC). The transparency framework has been evolving in detail and complexity aimed at maximizing mutual confidence amongst Parties while ensuring that Parties are not unduly stretched beyond their capacities. The formal reporting and reviewing process was first mandated as a requirement for Parties as mentioned in the text of the UNFCCC with differing degree of mandate for developed and developing Parties. Additional reporting requirements have since been introduced through the *Kyoto Protocol* (2005) and subsequent decisions such as the Bali Action Plan and Cancun decisions. More recently, in December 2015, through Article 13 of the *Paris Agreement* (PA), Parties have agreed to undertake actions with a view to build mutual trust and confidence and promote the efficient implementation of Nationally Determined Contributions

(NDCs) as also act on obligations under the PA through a robust *Enhanced Transparency Framework* (ETF).

At the 24th meeting of the *Conference of Parties* (COP24), held in Katowice, Poland, in December 2018, Parties to the PA adopted *Modalities, Procedures and Guidelines* (MPGs) as a part of the 'Katowice Climate Package' to further elaborate Article 13 of PA, laying down 'common' guidance for the reporting and reviewing actions on mitigation, adaptation and support for all Parties with flexibility for developing Parties in the light of their capacities. The new reporting requirements under the ETF supersede the existing ones and entail some elements that are new to many developing countries, such as India, implying the need for additional institutional and capacity needs going further.

This working paper intends to capture the recent developments on ETF post-COP24, its implications on developing Parties and assess India's institutional readiness to comply with emerging requirements under the ETF so as to effectively implement the PA.



1.1 Evolution of MRV obligations under the UNFCCC process

As mentioned above, evaluating progress towards achieving the 1.5°C goal requires information, in the form of both national GHG inventories and the mitigation actions taken up by Parties and their impact on GHG emissions. The concept of *measuring (or monitoring), reporting and verification (MRV)* has evolved : (Figure 1) from the initial UNFCCC text mandates which were aimed at promoting the uptake, tracking and communication of climate actions, has over time become a robust framework. UNFCCC came into force in 1994, with Parties committed to stabilize 'greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system' (UNFCCC 1992). The information on how each Party is implementing their Convention commitments to mitigate and adapt to climate change became a part of what is now known as *National Communications (NATCOMs)* (Articles 4.1 and article 12.1 of UNFCCC, 1992)

During COP 1, the Parties discussed the need to establish a legally binding commitment to limit emissions, quantified in relation to 1990 levels as per Decision 1/CP.1, and they set the goal of reaching agreement on this commitment by the third session of the COP (UNFCCC 1995). At this early stage, transparency was seen as a principle that, when applied by Parties, would ensure clarity in their reporting obligations. The Bali Action Plan adopted at COP 13 in 2007 called for Measurement, Reporting and Verification (MRV) of climate action. This was negotiated in the following years and was concluded in COP 16 held in Cancun, Mexico (2010), where elements of existing MRV were adopted and introduced the reviewing process which is known as the International Assessment and Review (IAR) for developed Parties and the International Consultation and Analysis (ICA) for developing Parties. Going further, the COP 21 adopted the PA with the aim to enhance the transparency framework for which the MPGs were adopted at COP 24 in Katowice that supersede the MRV system established by decision 1/CP.16 (Cancun Agreement). Table 1 showcases key elements of the existing transparency framework and the enhanced transparency framework as adopted by the Parties over the years.

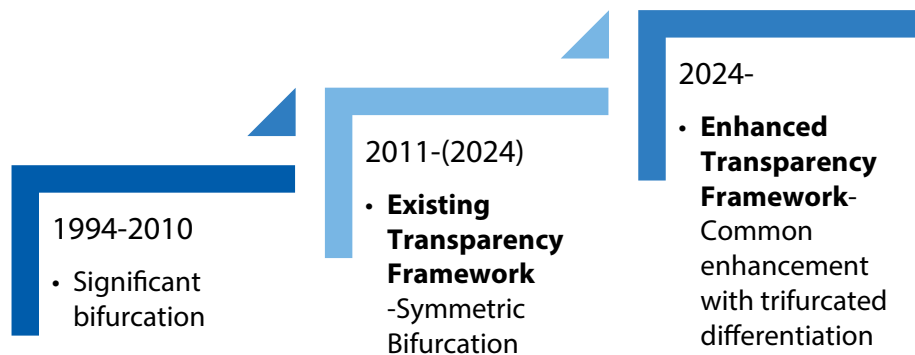


Figure 1: Evolution of transparency in the international regime



Table 1: Existing Transparency Framework vs Enhanced Transparency Framework

Obligation	Existing Transparency Framework	Enhanced Transparency Framework (ETF)
Report on mitigation targets and actions	<p>Developed Parties report GHG inventories every year and mitigation actions as a part of National communications (NATCOM) every four years and Biennial Reports (BRs) every two years.</p> <p>Developing Parties report on GHG inventories and mitigation actions as a part of its National Communications (NATCOM) every four years and Biennial Update Report (BURs) every two years.</p>	All Parties to submit Biennial Transparency Report (BTRs) providing information on national GHG inventories, progress on mitigation and adaptation targets as mentioned in the Parties' NDCs.
Report on support provided/ needed for implementation	<p>Developed Parties provide information on support provided. (NATCOM/BRs)</p> <p>Developing Parties provide information on support needed. (NATCOM/BURs)</p>	<p>Developed and developing Parties to report on support provided.</p> <p>Developing Parties report on support needed and received.</p>
Review process	<p>International Assessment and Review (IAR) for developed Parties</p> <p>International Consultation Assessment (ICA) developing Parties</p>	A common review process that reflects flexibility for developing countries.

1.2 Navigating through Article 13 negotiations: Where do we stand post-COP24?

Enhanced transparency framework (ETF), as set out in the Paris Agreement (PA) and its rulebook, is a critical component in the international climate negotiation regime, capturing core data and information on mitigation and adaptation action and support across sectors to inform governments, civil society and the international community of progress on climate action. MPGs adopted at the COP24 calls for Parties to submit **Biennial Transparency Reports (BTRs)** from 2024, developed by applying common reporting formats, although with different levels of rigour in

reporting. This will be mandatory for developed countries, while Least Developed Countries (LDCs) and Small Island Developing States (SIDS) may do so 'at their discretion', and other developing Parties may do so with limited flexibility. Further, all Parties are to report GHG emissions as per the **2006 IPCC guidelines for estimating their GHG emissions** with no more than two years in arrears. This is to be done using '**common reporting tables (CRT)**' and a '**common tabular format (CTF)**', elements for which were discussed during SBSTA50 held in June 2019, and further will be adopted at COP26 (to be held in 2020).

Table 2 summarises the key elements of the MPGs of Article 13 as presented in the negotiation text.



Table 2: Adopted Guidelines for Biennial Transparency Report (BTR) at COP24

Adopted Guidelines for Biennial Transparency Report (BTR)			
National Inventories			
Element ¹	Developed	Developing	LDCs/SIDS
M	Parties to measure GHGs emissions of all seven Kyoto gases with a key category threshold of 95%. Time series going back to 1990 with 2 years back date and emission projections of 15 years beyond next round year. (Annex MPGs II. para 25, 48, 57 and 58)	Parties to measure GHGs emissions of at least three Kyoto gases (CO ₂ , CH ₄ and N ₂ O) with a key category threshold of 85%. Parties to maintain a consistent annual time series from at least 2020 onwards, covering at a minimum, the reference year/period for its NDC (Annex MPGs II. para 25, 48, 57 and 58)	At Discretion (Annex MPGs para 11)
R	Parties to provide a National Inventory Report(NIR) of anthropogenic emissions by sources and removals by sinks of all seven GHGs in the form of CRTs (Annex MPGs. para 10)	Parties to provide a NIR of anthropogenic emissions by sources and removals by sinks of at least three GHGs (CO ₂ , CH ₄ and N ₂ O) as well as any of the additional four gases (HFCs, PFCs, SF ₆ and NF ₃) that are included in Party's NDC, in the form of CRTs (Annex MPGs. para 10)	At Discretion (Annex MPGs. para 11)
V	Parties are subjected to in-country review by a technical expert team for the first BTR and at least 2 BTRs within 10 years, and if recommended by TER of previous BTR (Annex MPGs. VII. Para 158). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.). The party shall elaborate an inventory QA/QC plan in accordance with the IPCC guidelines, including information on the inventory agency responsible for implementing QA/QC.	Parties are encouraged to undergo an in-country review by a technical expert team with a flexibility of choosing between centralized and in-country review (Annex MPGs. VII. Para 159). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.). Parties are encouraged to elaborate an inventory QA/QC plan in accordance with the IPCC guidelines, including information on the inventory agency responsible for implementing QA/QC	Parties may choose to participate in a centralized review as a group where a single expert review team will review several BTRs from the LDCs and SIDS (Annex MPGs. VII. Para 157). Parties further have the flexibility to choose to participate as a group in facilitative, multilateral consideration process (Annex MPGs. VIII. Para 194).

Table 2 Contd...

¹M-Measuring, R-Reporting, v-Verification

Report and Progress on NDCs: Mitigation Actions/Commitments (Article 4 of the PA)			
Element	Developed	Developing	LDCs/SIDS
M	Each Party to provide recent information on selected indicator for reference point(s), level(s), baseline(s) or starting point(s) for each previous reporting years during the implementation period to track NDC progress where applicable (Annex MPGs III.C para 67, 77a and 77b)		
R	Parties to report on national circumstances relevant for NDC progress and implementation, legal framework, institutional arrangement, information on article 6, contribution from the LULUCF sector for each year of the target period/year and co-benefits to extent where applicable (Annex MPGs III.C para 67, 77a, 77b, 77c, 77d)		
V	Parties are subjected to in-country review by a technical expert team for the first BTR and at least 2 BTRs within 10 years, and if recommended by TER of previous BTR (Annex MPGs. VII. Para 158). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.).	Parties are encouraged to undergo an in-country review by a technical expert team with a flexibility of choosing between centralized and in-country review (Annex MPGs. VII. Para 159). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.).	Parties may choose to participate in a centralized review as a group where a single expert review team will review several BTRs from the LDCs and SIDS (Annex MPGs. VII. Para 157). Parties further have the flexibility to choose to participate as a group in facilitative, multilateral consideration process (Annex MPGs. VIII. Para 194).
Adaptation Communication (Article 7 of the PA)			
Element	Developed	Developing	LDCs/SIDS
M	Each party is requested ("should") to provide information on impacts, risks and vulnerabilities to climate change. They should mention their adaptation priorities, barriers, strategies, policies including plans, goals, actions and progress (M&E) Not Mandatory		
R			
V	Not subject to review or verification (Annex MPGs. VII. A para 146a)		
Finance, Technology & Capacity Building (support needed and received under Articles 9- 11 of the PA)			
Element	Developed	Developing	LDCs/SIDS
M	Not Required	National circumstances, institutional arrangements and country-driven strategies, Underlying assumptions, definitions and methodologies, Information on financial support received by developing country Parties under Article 9 of the Paris Agreement	
R	Not Required	Parties are requested to provide information on financial support received by developing country Parties under Article 9 of the Paris Agreement using CTFs (Annex MPGs VI.D). Reporting format for other information is not specified.	
V	Not subject to review or verification (Annex MPGs. VII. A para 146a)		

Table 2 Contd...



Table 2 Contd...

Finance, Technology & Capacity Building (support provided & Mobilised under Articles 9- 11 of the PA)			
Element	Developed	Developing	LDCs/SIDS
M	Parties to provide information on their national circumstances and institutional Arrangements, Underlying assumptions, definitions and Methodologies, financial support provided and mobilized: Bilateral, multilateral, regional, public interventions and other channels (Annex MPGs V. para 118- 144)	Parties are encouraged to provide information on support provided and mobilized (Annex MPGs V. para 118) Not Mandatory	
R	Parties to provide information on financial support provided using CTFs (Annex MPGs V.C. para 123 and 124) Reporting format for other information not specified in MPGs.	Parties are encouraged to provide information on support provided and mobilized (Annex MPGs V.C. para 118) Not Mandatory	
V	Parties are subjected to in-country review by a technical expert team for the first BTR and at least 2 BTRs within 10 years, and if recommended by TER of previous BTR (Annex MPGs. VII. Para 158). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.).	Parties are encouraged to undergo an in-country review by a technical expert team with a flexibility of choosing between centralized and in-country review (Annex MPGs. VII. Para 159). Party's NIR submitted in a year in which a BTR is not due shall be subject to a simplified review (Annex MPGs. VII. Para 161). The party will also be subjected to facilitative, multilateral consideration process (Annex MPGs. VIII.).	Parties may choose to participate in a centralized review as a group where a single expert review team will review several BTRs from the LDCs and SIDS (Annex MPGs. VII. Para 157). Parties further have the flexibility to choose to participate as a group in facilitative, multilateral consideration process (Annex MPGs. VIII. Para 194).



1.3 New and emerging MRV needs for developing Parties

Experience with the current reporting mechanism under the UNFCCC revealed that many developing Parties face challenges in complying with the existing requirements.² The new reporting requirements under the ETF supersede the current ones and entail some elements that are new to many developing countries. For example, while majority of the developing Parties rely on the 1996 *IPCC guidelines* to measure their GHG emissions at the moment, with the adoption of ETF, all Parties will have to adopt 2006 *IPPC guidelines* for preparing their GHG inventories and are encouraged to report on least three GHGs (CO₂, CH₄ and N₂O) and four IPCC sectors—Energy sector, Industry Process and Product Use (IPPU) sector, Agriculture, Forestry and other Land Use (AFOLU) sector and Waste sector³—providing detailed information on GHG sources and sinks. Therefore, the challenging task for developing Parties is expected to be related to formalizing, implementing and maintaining sustainable national arrangements for preparing national communications; increasing the accuracy and completeness of GHG inventories as per the *IPCC 2006 guidelines*; understanding methodologies as per the IPCC 2006 guidelines and the indicators that would be needed to track progress in implementing and achieving the NDCs. In addition to this, it would be essential to develop projections on GHG emissions, understand adaptation priorities, and track progress on implementing adaptation actions and participating in the technical expert review.

In doing so, some of the **key challenges faced by developing Parties** arise from constraints categorized as follows:

- **Data Constraints:** The quality and reliability of a Parties GHG inventory is largely dependent on the type of activity data and emission factors used for assessment.

Data availability is one of the most pressing constraints for developing Parties where collation of data has not been intensive/ does not take place at all. The data and information are often collected from national aggregated levels rather than from point or direct source. This makes it difficult for Parties to move from Tier I to higher levels of methodology and leads to uncertainty in assessment. For instance, in the case of South Africa (non-Annex I), data availability has been the key challenge for preparing the GHG inventory for the key sectors, including AFOLU and IPPU. As a result, Tier 1 approach has been used for these sectors.

- **Capacity Constraints:** Many developing countries face limitations in terms of requirement of technical skill as well as requirement for increased networking between institutions. In most developing Parties, there are ad hoc institutional arrangements for preparing national communications with no clear and defined roles and responsibilities for participating ministries (Kato, 2007). Further, there is often inadequate specific legislative and/or policy support for capturing data related to climate change initiatives. As seen in the case of the Republic of Ghana (non-Annex I), building a stronger and better defined institutional framework, involvement of more approaches from private sector, and advancement of Tier I methods to Tier III remains some of the key challenges in the process of preparing GHG inventories.
- **Financial Constraints:** For all the areas of data and capacity enhancement, provision of financial resources is of paramount significance. For any developing Party, with low resources and economy, the biggest challenge is acquiring funds for mitigating climate change problems and building technical and institutional systems to prepare a comprehensive national communication.

² Best Practices on National GHG Inventory Management System: Case studies from South Africa, Ghana, South Korea, Japan and Chile, TERI 2018, available online at <https://www.teriin.org/casestudies/best-practices-national-ghg-inventory-management-system-case-studies-south-africa-ghana>

³ As per 2006 IPCC guidelines, greenhouse gas emission and removal estimates are divided into four main sectors integrating Agriculture and Land Use, Land-Use change and Forestry. Further details available online at https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/0_Overview/V0_1_Overview.pdf



2. DEFINING INSTITUTIONAL READINESS FOR ENHANCED TRANSPARENCY FRAMEWORK

In this section, we attempt to define the concept of *Institutional Readiness* and present three parameters which can be used for assessing readiness of institutions.

Historically, 'institutions' are widely understood as "the formal or informal procedures, routines, norms and conventions embedded in the organizational structure of the polity or political economy" (Hall and Taylor 1996). The MPGs of ETF, as explained in the previous section, pose urgent challenges for developing Parties in terms of policy and, consequently, institutional (re)arrangement and reforms. Taking clue from previous sections, it is clear that the adopted MPGs offer lesser scope of 'flexibility' for developing Parties. Therefore, it becomes important to assess the institutional readiness in India for complying with the new requirements under ETF.

In this paper we define '*Readiness*' as "the degree to which an institution is prepared or ready to effectively implement the new and emerging needs". Institutional Readiness or the preparedness to respond to emerging needs and adapt to new ways of doing things determines to a great extent how effectively institutions can deliver with mixed support of (i) robust processes, (ii) adequate human resources and (iii) technological capacities. The assessment presented in this section is the measurement of the gap between current MRV practices and the new emerging needs from the ETF. We have identified and grouped the dimensions that result in institutional readiness into three key parameters (Figure 2). Our assessment will therefore focus on readiness level in these three key parameters as explained below:

- **Readiness parameter 1: Human Resources**

For any institutional readiness, the human resources are a critical and perhaps the most important element to accept the change. Human resources in this context are referred to as the government organizations, civil society organizations, and academic institutions, etc., that participate in the current national communication system in India.

- **Readiness parameter 2: Technological Capacity**

Technological readiness focuses on the evaluation of the measuring and reporting capacities focusing on technologies, existing methodologies and infrastructure to measure GHG emissions in various sectors.

- **Readiness parameter 3: Supporting Policies and Process Readiness**

Supporting process refers to evaluation of support functionalities, current policy action functionalities, existing business processes, etc., that are embedded in the system and can be leveraged to improve domestic MRV. In India, major supporting policies in various sectors stem from the different sectoral Acts, schemes and eight missions set under the National Action on Climate Change (NAPCC). Supporting processes also refer to the operating and enabling environment within the country. It is concerned with the evaluation of issues such as governance framework, legal powers/frameworks, policies and current practices, etc., that provide a suitable environment for collaboration and cooperation for an effective MRV system to function.

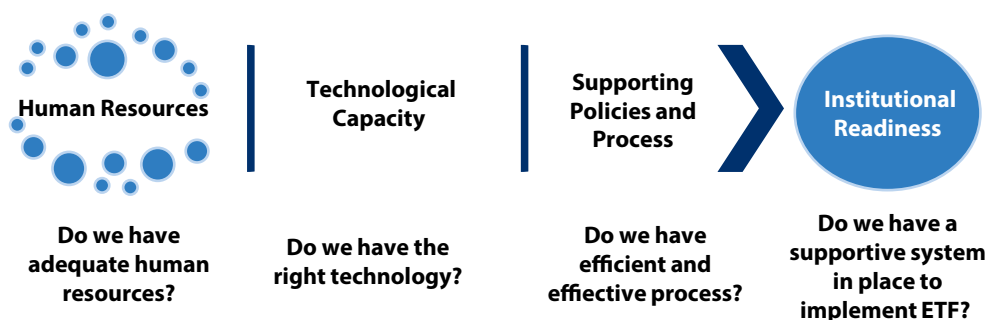


Figure 2 Parameters for assessing Institutional Readiness



3. ASSESSING INDIA'S INSTITUTIONAL READINESS TO IMPLEMENT THE ENHANCED TRANSPARENCY FRAMEWORK

This section begins by understanding institutional network for national communications in India. This is followed by institutional readiness assessment of GHG interiorization process of five IPCC sectors under NATCOM and BUR preparation in India so far. The focal point of the analysis relates to the 3 parameters defined in the previous section (*human resource capacity, technological capacity and supporting policies and processes*). Finally, this section concludes by providing a few starting points for moving towards a streamlined domestic MRV system in order to better comply with the requirements under ETF.

3.1 India's Institutional Framework for National Communications

India has been reporting its national communications ever since signing the United Nations Framework Convention on Climate Change (UNFCCC) on June 10, 1992. India's international climate position and extent of domestic climate change policy has evolved by increasing institutions for climate governance with every communication. The process of developing national communications has triggered large-scale networking, capacity-building and the involvement of research organizations and various government departments. India has been adopting a broad-based participatory approach for estimating the national GHG emission inventories. The institutional framework of NATCOM serves as the backbone of this process, providing definition and strength to it. At the

same time, it leads to a transparent and streamlined work methodology. Further, it clearly draws the boundaries of roles and responsibilities of the scientific community and polity, thus maintaining a balanced participation of stakeholders. Also, worth mentioning is the evolving network of scientific institutions under NATCOM, which work in coalition for generation of the GHG inventory and scenarios for NATCOM. These networks are supported financially and logistically by the government (through the project management committee), and supervised by a team of specialists from both political and scientific domains. NATCOM and BURs, thus, hints towards an evolving framework of multi-level networked governance architecture in India.

As per the roles of various organizations/actors in the process, the institutional framework of NATCOM can be broadly classified as the following:

- **Executive Agency:** *The Ministry of Environment, Forest and Climate Change (MoEF&CC)*, is the executive agency for climate change issues and is responsible for managing climate change related-programmes and reporting information pursuant to Article 4.1 of the Convention. A Climate Change Division within MoEF&CC carries out functions of planning, promotion, coordination, and overseeing implementation of various sectoral plans and programmes on both adaptation and mitigation initiatives in India. (Table 3)

Table 3: Institutional framework for National Communications in India

Institutional framework for National Communications to UNFCCC		
	Administrative Levels	Number of Personnel
Ministry of Environment, Forest and Climate Change (MoEF&CC)	Special Secretary/ Additional Secretary/ Joint Secretary/ Scientist (G)	1
	Director/ Deputy Secretary/ Scientist (D, E, F)	3
	Deputy Director	1
	Section Officer/ Technical Officer	2
Project Management Cell	National Project Director	1
	Programme Officer	6



- **Project Management Cell (PMC) under supervision of national project director:** National communications are prepared and consolidated by *Project Management Cell* or the NATCOM cell situated within the MOEF&CC. The cell acts as the managerial body for the process.
- **The National Steering Committee (NSC) and the Technical Advisory Committee (TAC):** The NSC and TAC together facilitate NATCOM exercise by provision of resources, scoping the assessment and providing technical advisory required by Assessment Agencies. They also facilitate linkages with technical experts internationally to ensure optimal quality of the work. Both of these are chaired by the Secretary of MoEF&CC.
- **Key ministries** involved in the process are Ministry of Power, Ministry of Coal, Ministry of Petroleum and Natural Gas, Ministry of Surface Transport, Ministry of Shipping, Ministry of Aviation, Ministry of Heavy Industries, Ministry of Iron and Steel, Ministry of Agriculture, Ministry of Environment and Forests, Ministry of Urban Development and Ministry of Statistics and Program Implementation. These ministries represent the source of activity data for majority of the source categories.
- **Network of Assessment Agencies:** The inventory preparation for each sector is coordinated by a lead institute and the measurement activities for developing

indigenous emission factors are coordinated by a leading researcher followed by network of expert institutions.

So far, India has submitted four national communications to the UNFCCC as presented in Table 4. As a part of its national communications and BURs, India reports on the five IPCC sectors—*Energy sector, industry process and product use, agriculture, forestry (LULUCF) and waste*⁴—providing detailed information on GHG sources and sinks. The choice of Tier 1, Tier 2 or Tier 3 methodologies for estimating emissions from different sectors depends on the availability of relevant activity data and indigenous emission factors for each sector. Application of Tier 1 methodology corresponds to sectors where activity data and IPCC default emission coefficients were used; Tier 2 methodology mainly corresponds to the sectors where sub-sector-activity data and indigenously developed emission factors for Indian conditions are available; and Tier 3 is applied to sectors with absolute measurements and monitoring.

The third NATCOM and BUR reports are currently under preparation. Further, adhering to the convention, India will have to submit its biennial transparency report in accordance with the MPGs adopted at COP24 in the year 2024. This implies to the urgent need to move sectors towards higher tier methodology in order to improve accuracy in estimations and reduce uncertainty.

Table 4: India's National Communications to UNFCCC

Communication/Report	Submission (Month, Year)	Inventory year	Emissions Recorded Million tCO ₂ e (includes LULUCF)	Expert Institutions
Initial National Communication: NATCOM1 (INC)	June, 2004	1994	1,288.54	19
Second National Communication: NATCOM2 (SNC)	May, 2012	2000	1,301.21	34
First Biennial Update Report: BUR1	January, 2016	2010	2,136.84	17
Second Biennial Update Report: BUR2	December, 2018	2014	2,306.29	16

⁴ As per 1996 IPCC guidelines, greenhouse gas emission and removal estimates are divided into five main sectors: Energy sector, Industry Process and Product use (IPPU) sector, Agriculture sector, Forestry (LULUCF) sector and Waste sector



3.2 Sector-wise institutional readiness analysis

Now, we attempt to assess the institutional readiness of GHG inventory process in India for complying with the needs of ETF, focusing on *human resource capacity, technological capacity and supporting policies and process* of the five IPCC sectors as represented in national communications:

3.2.1 Energy Sector

The first energy inventory was submitted to the UNFCCC in 1994. Since then, four more inventories have been prepared for the years 2000, 2010, 2007 and 2014 and submitted to the UNFCCC. Energy sector, being the largest GHG emitter accounts for emissions from fossil fuel combustion of energy industries, manufacturing industries, transport and other sectors such as residential, commercial, etc. The sector also includes fugitive emissions from coal mining, oil and natural gas. In 1994, the energy sector emitted a total of 743,820 Gg CO₂ eq. amounting to 61% of the total emissions. Within the energy sector, emissions from sub-sector, energy and transformation industries, contributed highest with 47.7% (355,037 Gg CO₂ eq.) of the total energy sector emissions. This was followed by manufacturing industry with 20.25% (150,674 Gg CO₂ eq.). The energy sector emitted 1,523,777 Gg CO₂ eq. of GHGs in 2000 (NATCOM1). The emissions increased to 1,510,120.76 Gg CO₂ eq. by 2010 (BUR1) and 1,909,765.74 Gg CO₂ eq. (73%) by 2014 (BUR2).

• Human Resource Capacity within Energy sector

The energy sector produces large volume of data that is relevant for GHG inventory reporting and accounting of mitigation actions. However, collating and analysing such huge, scattered volume of information is a big challenge in itself. As a result of this, for each national communication submitted so far, the energy sector has involved an appropriate mix of government, academic and civil societies. The key institutions involved in previous communications have been elucidated in Table 5.

Further, the Central Electricity Authority (CEA) is the statutory authority to seek information and monitor performance of the power sector. Institutions such as Bureau of Energy Efficiency and the central and state pollution boards (CPCB, SPCBs) also play a critical role.

• Technological capacity within Energy sector

Inventory for energy sector has predominately been based on the Intergovernmental Panel on Climate Change (IPCC) 1996 revised Guidelines (IPCC, 1996). However, in BUR1 and BUR2, many elements have also been adopted from the 2006 IPCC guidelines for estimating GHG emissions. Activity data in terms of consumption of fossil fuels is obtained from the reports of relevant ministries within the government, which keep track of the activities. The emission factors of fossil fuels, such as coal, oil, and natural gas, are the most important considerations in estimating the GHG emissions from the combustion of these fuels.

Table 5: Key Institutions in Energy Sector

NATCOM 1	NATCOM 2	BUR1	BUR2
Development Alternatives (DA)	Central Institute of Mining and Fuel Research (CIMFR)	Indian Institute of Management, Ahmedabad (IIM A)	Indian Institute of Management, Ahmedabad (IIM A)
Central Mining Research Institute (CMRI)	Central Road Research Institute (CRRI)	Central Institute of Mining and Fuel Research (CIMFR)	Central Institute of Mining and Fuel Research (CIMFR)
Central Fuel Research Institute (CFRI)	Indian Institute of Petroleum (IIP)	Central Road Research Institute (CRRI)	IORA Ecological Solutions
Cement Manufacturers Association (CMA)	Jadavpur University	Indian Institute of Petroleum (IIP)	Indian Institute of Petroleum (IIP)
	National Environmental Engineering Research Institute (NEERI)		
	The Energy and Resources Institute (TERI)		
	Petroleum Planning and Analysis Cell (PPAC)		



The energy inventory presented in BUR2 includes Tier 1, Tier 2 and Tier 3 approach for estimating CO₂ emissions from fossil fuel combustion in energy, manufacturing and construction industries with a mix of country specific and IPCC default fuel emission factors. For transport, residential and commercial sectors, Tier 1 and Tier 2 approaches are followed for estimating CO₂ emissions. Estimation of methane (CH₄) and N₂O emissions of fuel combustion activities, Tier1 approach has been adopted along with the use of IPCC default fuel emission factor. Further, estimation for fugitive emissions, Tiers 2 and 3 have been adopted to estimate CH₄ emissions using a mix of country specific and IPCC default fuel emission factors.

Going further, in preparing for reporting under BTR, urgent requirements from the energy sector includes employing 2006 IPCC guidelines for estimating GHG emissions throughout the sub-sectors and eventually develop Tier 3-based inventories for CO₂, CH₄ and N₂O gases. This translates into the need for advancement of current methodologies for estimating GHG emissions along with increasing sectoral coverage and data collection in all the fuel-consuming industries. This can be financially challenging, especially for estimating fugitive emissions from the oil and natural gas sector which requires technological up gradation of inventory estimation.

Secondly, at present emission estimation from activity data accessible in different government and sectoral annual reports/publications is a major challenge since the scope of data coverage is different for each report and is often not in the required format for segregation and direct use for sectoral inventory preparation. This makes it necessary to develop mechanism streamline activity data from various sub-sectors and obtain information on fuel consumption to get a more disaggregated picture of the total GHG emissions. Another key issue is the incorporation of uncertainty assessment. The uncertainty is particularly high in sectors, such as residential energy, agricultural energy, cement, iron and steel and food and beverage. The key challenge here is to improve the accuracy of activity data generation on a continuous basis.

With respect to transport, it is imperative to develop emission factors for different fuels, vehicle types and traffic patterns for the road transport sector. Apart from the emission inventory these will be helpful in source apportionment and development of future scenario for policy intervention/mitigation.

It is imperative that the GHG inventory of the energy sector should be developed in a robust manner keeping in mind the accuracy and frequency of activity data generation, employing country-specific emission factors wherever possible, the optimum level of data disaggregation and quality controls and checks wherever possible. These measures can aid in developing an automated inventory management system and also help in moving up the tier ladder and report on more gases by enhancing technological capacity and capabilities of institutions involved in inventory preparation over time. However, it is noteworthy that the institutional and technical capacity of the country for estimation for energy sector is up-to-date, with dedicated institutions engaged in research on the area. The future national communications should see a better alignment of their work with the incentivization process, benefitting the numbers generated in future.

• **Supporting Policies and Processes within Energy sector**

There are various policies and processes that support in reporting for the sector such as the *User Guide* for CO₂ Baseline that helps in establishing a CO₂ baseline for the power sector which is released annually by the Central Electricity Authority (CEA); *Energy Labeling of electrical appliances (S&L)*, such as air conditioners and refrigerators has been a key demand side management scheme. For the transport sector, there are schemes with a focus on electrification of Railways, building dedicated Freight Corridors for Indian Railways and fuel efficiency improvements in aviation. Further, in recent times, the government has introduced several information technology-based initiatives for tracking sectoral developments which include *Vidyut Pravah* mobile application that provides information on power generation and supply; *Merit Order Dispatch of Electricity for Rejuvenation of Income and Transparency (MERIT)* that promotes overall operational efficiency of the power sector; *Urban Jyoti Abhiyan (URJA)* and *Ujwal Discom Assurance Yojana (UDAY)* help in mitigation measures through: mapping of power losses; checking power thefts; smart metering at the consumer end; and demand side management to reduce peak load and energy consumption. Apart from this, dashboards for schemes such as the Unnat Jyoti by Affordable LEDs (UJALA) has illustrated a clear and well-defined MRV for the sector presenting annual energy savings, CO₂ reduction and progress on the scheme. In addition, Indian Railways operations are now included in the Perform, Achieve and



Trade (PAT)–II cycle, which has an inbuilt MRV process that establishes the overall improvement in terms of energy efficiency and depicting impact on emission reductions. Going further, such IT-enabled dashboards could be built for other schemes in the sector to improve transparency and enhance the reporting process.

3.2.2 Industry Process and Product Usage (IPPU) Sector

Industrial processes and the product use sector accounts for about 8% of the total GHG emissions (2014, BUR2). The sector accounts for emissions from mineral products, chemicals, metal production, non-energy product use and other production such as production of halocarbon and consumption of SF₆. The sector involves multi-level interaction with industry stakeholders and bodies. There are thousands of individual plants spread across India that are required to be mapped for their contribution to GHG emissions and also to document their contributions to GHG emission mitigation. There are also many Micro, Small and Medium Enterprise (MSME) sector players, including micro household-based businesses. Many of these are in un-organized sectors and information/data on these needs to be collected through primary surveys on a regular basis. It is a challenging task to establish such systems for timely and continuous estimation of GHG inventories from all the sub-sectors.

• Human Resource Capacities within IPPU sector

The IPPU inventory has been evolving with inclusion of more subsectors from the INC to the BUR2. As a result of this, the number of institutions involved in inventory preparation has increased from the first inventory to the second inventory. For example, to accommodate inclusion of land use change, remote sensing institutions were involved in the inventory process. Table 6 summarizes the institutions involved in the INC and in the SNC. The first NATCOM included three research institutions and one government agency, whereas the second NATCOM and the first BUR included two government agencies and one research institutions while the BUR2 included two government agencies. Indian industry associations, and notably the Confederation of Indian Industry (CII), played a substantial role in providing an interface between the MoEF&CC and individual companies and sectors, managing details of greenhouse gas inventories, reporting and other requirements of the BUR process.

• Technological Capacity within IPPU sector

The IPPU sector inventory is predominantly based on Tier 1 and Tier 2 approaches. Estimation for CO₂ in national communications is based on Tier 2 methodology for iron, steel, cement and a few subsector from chemicals, whereas Tier 1 is used for other categories within the sector. Further, country-specific factors are developed for cement, nitric

Table 6: Key Institutions in IPPU Sector

NATCOM 1	NATCOM 2	BUR1	BUR2
National Chemical Laboratory (NCL)	Central Institute of Mining and Fuel Research (CIMFR)	Confederation of Indian Industry (CII)	Confederation of Indian Industry (CII)
Central Glass and Ceramic Research Institute (CGCRI)	Cement Manufacturers Association (CMA)	National Environmental Engineering Research Institute (NEERI)	National Environmental Engineering Research Institute (NEERI)
Cement Manufacturers Association (CMA)	Confederation of Indian Industry (CII)	Indian Institute of Management, Ahmedabad (IIM A)	
The Energy and Resources Institute (TERI)	Jadavpur University		
	National Environmental Engineering Research Institute (NEERI)		
	The Energy and Resources Institute (TERI)		



acid production, and aluminium production while for other subsectors, country-specific emission factors are under development and estimation is based on default IPCC emission factors.

Going further, in developing BTR, major challenge from IPPU sector, a majority of industries are small, unorganized, and scattered and, therefore, the biggest challenge was to obtain a reliable dataset. Except for cement, iron and steel, and aluminium, inventory of other sub-sectors required collection from individual plants and listed companies. Tier 2 methodologies and country-specific emission factors were used for cement and iron and steel and Tier 1 methodology and IPCC default emission factors were used for all the other sub-sectors. However, Tier 1 methodology was used predominantly for CH₄ and N₂O emissions in all the sub-sectors. Therefore, one of the challenges is to create mechanisms for incentivization of industries within each sub-sector for fast and efficient data collection. Upgrading to Tier 2 for cement, for instance, suggests that a detailed assessment was undertaken to arrive at a higher resolution of activity data, including activity data on clinker production. Additionally, the derivation of country-specific emissions factor was also undertaken. The challenge is to develop mechanisms to collect activity data with higher detail and country-specific emission factors for the additional sub-sectors to facilitate accurate incentivization. Specifically, iron and steel, one of the top emitters, still has no distinction between coal consumed for energy use in plant and coking coal used as a reducing agent in the blast furnace for iron (chemical process; to be covered under the IPPU). In the SNC, iron and steel emissions have been reported within the energy sector. This is an issue with a resolution. One of the ways to solve this problem can come from increasing activity data resolution wherein a detailed technological study of processes within the plant will also be beneficial in determining the amount of coal used for different processes. This could very well be extended in the case of cement and aluminum. Further, there is a need to strengthen technological capacities of laboratories for fuel testing.

- **Supporting Policies and Process within IPPU sector**

The IPPU sector inventory is supported by institutional network of mechanism such as the Perform Achieve and Trade (PAT) – I, II, III, IV; Zero Defect Zero Effect. The

PAT scheme, is an innovative policy mandate, market-based instrument, launched in 2012 under the National Mission on Enhanced Energy Efficiency (NMEEE). PAT has successfully demonstrated its capacity to spur innovation in the energy-intensive industrial sector in India, laying down regulations and building an institutional network for multiple sub-sectors and industries to measure, report and verify their energy savings. However, slight modification in its calculations to translate energy savings into tonnes of carbon dioxide equivalent and vice versa, could ensure the long-term sustainability of PAT scheme and enhance reporting mechanism within the IPPU sector.

3.2.3 Land Use, Land-Use Change and Forestry (LULUCF) Sector

The land use, land-use change and forestry sector inventory has made significant progress between the 4 submitted reports. The LULUCF is a key component of the GHG inventory, involving estimation of carbon stock changes, CO₂ emissions and removals, and non-CO₂ GHG emissions. As per BUR2, about 12% of India's GHG emissions were offset by the LULUCF sector.

- **Human Resource Capacity within LULUCF sector**

From an undefined and unstructured layout of institutions and stakeholders in the 1994, the inventory reporting system for forestry sector has transformed into a comparatively strong and well defined one since NATCOM2 with 16 institutions working on the sector alone. Institutions in this sector have started building capacity for climate change research, which includes modeling, field ecological studies and laboratory experimentation. The National Remote Sensing Centre (NRSC) has played a significant role since INC undertaking remote sensing-based monitoring of land use and land cover in India. The Forest Survey of India (FSI) biennially generates a report on the State of Forests in India which publishes data on the area under forests in different tree crown density classes at the state and district level. The forest area estimates are based on remote sensing data. FSI also provides data on the area under the category Trees Outside the Forests (TOF). It also periodically estimates the carbon stock changes of forests based on the stock change method. FSI monitors the carbon stock change in trees outside the forests.



Table 7: Key Institutions in LULUCF Sector

NATCOM 1	NATCOM 2	BUR1	BUR2
Forest Survey of India (FSI)	Forest Survey of India (FSI)	Indian Institute of Science, Bengaluru (IIS, B)	Indian Institute of Science, Bengaluru (IIM, B)
Forest Research Institute (FRI)	Indian Council of Forestry Research and Education (ICFRE)	National Remote Sensing Centre (NRSC)	National Remote Sensing Centre (NRSC)
	Indian Institute of Science, Bengaluru (IIS, B)	Forest Survey of India (FSI)	
	National Remote Sensing Centre (NRSC)		
	Arid Forest Research Institute		
	Advanced Research Centre for Bamboo and Rattans		
	Centre for Forestry Research and Human Resource Development		
	Centre for Social Forestry and Eco-Rehabilitation		
	Forest Research Centre (FRC)		
	Himalayan Forest Research Institute (HFRI)		
	Institute of Forest Genetics and Tree Breeding (IFGTB)		
	Institute of Forest Productivity (IFP)		
	Institute of Woods Science and Technology (IWST)		
	Rain Forest Research Institute (RFRI)		
	Tropical Forest Research Institute (TFRI)		

• Technological Capacity within LULUCF sector

Emission inventory of LULUCF sector is largely dependent on estimation of carbon stock changes, CO₂ emissions and removals, and non-CO₂ GHG emissions. In BUR2, LULUCF inventory is based on the IPCC-Good Practice Guidance (GPG), 2003 approach and also includes some elements from the 2006 IPCC Guidelines. Tier 2 was applied to four key sectors: a) changes in forest land; b) grassland conversion; c) cropland; and d) settlement and other land.

The major technological challenge faced by LULUCF sector is the unavailability of data. While there have been improvements in meeting data needs between NATCOM1 and BUR2, there are still limitations in the scope of data availability and data presentation relating to forest, crop and plantation types, land use data, dominant tree species, soil carbon data, fuel wood consumption, etc. Every two years, the Forest Survey of India (FSI) produces reports on frequently recorded forest and plantation types however



there is a need to establish this information as spatial maps, including detailed land use in terms of forest and crop and plantation types which can be directly used by ISRO-Bhuvan. Further, a real time monitoring system should also help to generate regular updates for the sector.

For the LULUCF, emission factors on a stratified resolution need to be developed based on the climatic zone and forest type. Development of country-specific emission factors, particularly for biomass expansion factor is an area that needs improvement as it is essential in extrapolating stock data. Further, soil carbon density data is available on a limited capacity as a result of which estimates for carbon dioxide and methane emissions from soils have not been included in the inventory.

Further, in preparing for BTR, India has the institutional and technical capacity to adopt Tier 3 methods and Approach 3 for land use measurement and analysis. India has been pursuing efforts to shift the GHG inventory for the LULUCF sector to Tier 3 method. India is planning to adopt a model-based GHG inventory system for the LULUCF sector, but the plan is hampered due to the absence of suitable land-use models and data. Capacity building is required to utilize the geo-referenced data from NRSC with the application of the EF data. Additional financial support is required to build capacity for the adoption of suitable carbon measurement models and for generating EFs (such as stocks and fluxes of five carbon pools) in different land categories. Currently, the urgent need reflects the development of country-specific carbon accounting models, increases inter-institutional partnerships fulfills international reporting standards and remains cost-effective in doing so.

• **Supporting Policies and Process within LULUCF sector**

The MOEF&CC and state governments have initiated multiple programmes relating to afforestation, reforestation, land-use area mapping and species mapping; some of which stem from the objectives set under the Green India Mission which is one of the eight missions of NAPCC. Further, the MoEF&CC has developed tools like Decision Support System (DSS) and e-Green Watch that facilitate informed decisions in matters dealing with use of forest land and resources. Of late, India has also initiated the Long-Term Ecological Observatories (LTEO) programme. Under this programme, the carbon fluxes of natural and man-made ecosystems at the landscape scale and carbon stock changes in soils associated with different forest types and land use patterns are proposed to be measured and monitored. However, this

may take several years before carbon flux data becomes available for inventory purposes. Further, not all carbon fluxes pertaining to all the land categories are monitored. Thus, availability of carbon flux data for all land categories, in particular, non-forestland categories, is a constraint at present. India has initiated a National Forest Inventory programme and carbon flux estimation in future will be based on this inventory. The National Bureau of Soil Survey and Land Use Planning (NBSSLUP), the Central Research Institute for Dryland Agriculture (CRIDA) and other institutions are involved in monitoring and estimation of soil carbon stocks in different land categories.

3.2.4 Agriculture Sector

The emissions from agriculture sector amounted to 16% of the gross emissions of India in 2014 with Methane (CH_4) and Nitrous Oxide (N_2O) being the major sources. The CH_4 emissions occur from this sector due to livestock rearing (enteric fermentation and manure management) and rice cultivation. N_2O is mainly emitted due to the application of fertilizers to the agricultural soils.

• **Human Resource Capacity within the Agriculture sector**

In the agriculture sector, measurements are conducted for CH_4 emission coefficients by the *National Dairy Research Institute (NDRI)*, Karnal. The institute is responsible for conducting experiments with support of data provided by the *National Physical Laboratory, New Delhi (NPL)*. The NPL is also involved in the measurement of emission coefficients of N_2O and CH_4 . This is obtained from estimating GHG emissions from the manure systems, rice cultivation under different water regimes and organic amendments, and burning of crop residue.

The *Indian Agricultural Research Institute (IARI)*, New Delhi, is broadly involved in the measurement of N_2O emissions from soils supporting rice-wheat systems in the country. They also conduct measurements to ascertain the emission coefficient of N_2O due to application of nitrogenous fertilizers.

Further, many research institutions and agricultural universities under the Indian Council of Agricultural Research (ICAR) are also engaged in data collection and research in the agriculture sector. The agronomy division of the ICAR, over the past 50-60 years, has gathered soil parameters for agricultural resource management. Agriculture-related weather data and grain-wise



Table 8: Key Institutions in Agriculture Sector

NATCOM 1	NATCOM 2	BUR1	BUR2
Institute of Radio Physics and Electronics (IRPE)	Bidhan Chandra Krishi Vishwa Vidyalaya	National Dairy Research Institute (NDRI)	National Dairy Research Institute (NDRI)
Regional Research Laboratory (RRL)	Central Leather Research Institute (CLRI)	Indian Agricultural Research Institute (IARI)	Indian Agricultural Research Institute (IARI)
Indian Agricultural Research Institute (IARI)	Indian Agricultural Research Institute (IARI)	National Physical Laboratory (NPL)	
Central Leather Research Institute (CLRI)	Indian Grassland and Fodder Research Institute (IGFRI)		
	Indian Veterinary Research Institute (IVRI)		
	National Dairy Research Institute (NDRI)		

agricultural yield data are collected at the local level at evenly distributed sites all over the country.

- **Technological Capacity within the Agriculture sector**

Agricultural inventory is predominantly based on the 2006 IPCC guidelines for estimating GHG emission. Data on country-specific emission factors for many fruit tree systems and crops is limited for Indian conditions. Little information is available on allometric equations and biomass expansion factors for horticultural species. Representative values for different agro-ecological regions are needed as these are distributed throughout the country, and their growth and biomass production are influenced by climate. Similarly, detailed database on various farm inputs such as water, fertilizers (both inorganic and organic), off-road vehicles, and energy requires enhanced generation and assimilation. Data collection on livestock dung production and its collection, cattle feed and enteric fermentation also needs further enhancement and refinement.

- **Supporting Policies and Process within the Agriculture sector**

Several initiatives have been taken to promote sustainable development of the sector including the National Mission on Sustainable Agriculture (NMSA), afforestation programme, Twenty Point Programme, etc. These initiatives largely focus on stabilization of forest area through afforestation and reforestation. Further, network project such as the National Innovations in Climate Resilient Agriculture (NICRA) has brought together institutions such

as the Indian Council of Agricultural Research (ICAR) and Ministry of Agriculture and Farmers Welfare to conduct strategic research covering crops, horticulture, livestock, natural resource management and fisheries sectors.

3.2.5 Waste Sector

The waste sector in India contributes to about 3% of the total GHG emissions (India BUR, 2014). The waste sector is expanding in India, offering many opportunities for mitigating GHG emissions from waste. GHG inventory estimation from municipal solid waste requires estimation of waste collection at landfills over a sustained period of time. The sector accounts for emissions from two key categories—solid waste disposal and waste water treatment and discharge which includes industrial, domestic and commercial waste water. Total emissions from waste sector for 2014 were 78,227.15 Gg CO₂e with waste water treatment and discharge being the main sources.

- **Human Resource Capacity within Waste sector**

The National Environmental Engineering Research Institute (NEERI) is one of the key government institution involved in waste sector inventory preparation since the first national communication submitted to UNFCCC. NEERI engages in research and development on solid waste and wastewater management in the country.

Further, the Central Pollution Control Board (CPCB), State Pollution Control Boards (SPCBs) and municipalities



Table 9: Key Institutions in Waste Sector

NATCOM 1	NATCOM 2	BUR1	BUR2
National Environmental Engineering Research Institute (NEERI)	National Environmental Engineering Research Institute (NEERI)	National Environmental Engineering Research Institute (NEERI)	National Environmental Engineering Research Institute (NEERI)
	National Physical Laboratory (NPL)	National Physical Laboratory (NPL)	

are statutory government organization responsible for collecting data and information on generation and treatment of solid waste and wastewater from domestic, commercial and industrial sources.

- **Technological Capacity within Waste sector**

At present, the process of preparing inventory for the waste sector poses multiple technological challenges requiring substantial financial, infrastructure up gradation and capacity building-related support.

Data availability seems to be a major challenge for sectors where collation of data has not been intensive/ does not take place at all. For example, one of institutions engaged in assessment of the waste sector identifies non-availability of relevant data as the most significant challenge in the sector. With no proper documentation of data on waste generation, there is requirement of more field studies and more plant level surveys to get industrial waste generation data. Data inaccessibility issues arise with industrial waste water activity data due to unwillingness of industries to share plant level data. There seems to be a lack of a centralized effort to involve industries and convince them for sharing information, particularly in the waste sector, thus leading to uncertainty in assessment.

In the waste sector, jumping up the tier ladder would hinge upon the technological capabilities and capacities to build city-specific GHG emission inventory rather than an India-average GHG inventory. India has 59 cities that have population over one million as per national census of 2011. There are hundreds of smaller cities and towns that are generating wastes. Almost all states have laws on managing this waste on a regular basis. Some states and cities (Jaipur and Ahmedabad) have started collecting methane from waste water treatment plants and using it for industrial applications. Urban center level information and data is to be collected and analysed from BUR and National Communication perspectives. Therefore, large amount of uncertainties is associated with waste sector inventory due to inadequate data availability.

The IPCC 2006 guidelines, requires about 5 half-life period data for estimating the MSW emissions. Acquiring 50 years of data on solid waste generation, collection, and disposal as well as characteristic of waste is a key challenge. Currently, half-life of waste is calculated based on India's average temperature and precipitation value, whereas this varies from one region to another, based on precipitation and average temperatures. This further implies the need for technological support to research institutes for initiating the study, and for capacity building to estimate MSW, industrial and domestic wastewater produced.

- **Supporting Policies and Processes within Waste sector**

Over the last decade, the Government of India (GoI) has taken several measures to address infrastructure development and improvements in the Waste Sector through introducing various laws. These laws are towards waste management including on hazardous waste, bio-medical waste, construction and demolition waste, municipal solid waste, plastic waste, and e-waste. Municipal authorities are responsible for implementation of these rules. Further, programmes such as the the Jawaharlal Nehru Urban Renewal Mission (JnNURM), the Urban Infrastructure Governance (UIG) and the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) have led to the creation of significant amount of infrastructure for efficient waste collection and treatment. In addition, the GoI's National Action Plan on Climate Change (NAPCC), gives significant priority to management of waste under one of its eight missions, the National Mission on Sustainable Habitat (NMSH). The NMSH addresses GHG emission from solid waste management and has laid out recommendations for improving the solid waste management system, to be taken up for inclusion in the legal provisions/bye-laws of state and/or city (MoUD, 2015). For improving solid waste management practices in urban areas, the GoI launched the Municipal Solid Waste (Management and Handling) Rules in 2000. These rules have specific guidelines for local, district and state level



departments for proper and scientific management of MSW. Under these rules, it is mandatory for all the urban local bodies to provide facilities for collection, transportation, treatment and disposal of MSW in a scientific Summary of GHG Trends 58 and hygienic manner (MoEFCC, 2000). The National Environment Policy, 2006, encourages the development of viable public private partnership (PPP) models for setting up and operating secure landfills, incinerators, and other waste processing technologies (MoEFCC, 2006). The Hazardous Wastes (Management and Transboundary Movement) Rules, 2008 were released by the GoI to ensure proper management of different types

of hazardous waste. The GoI launched the Plastic Waste (Management and Handling) Rules in 2011 to reduce the generation of plastic waste and ensuring its proper disposal. The E-waste (Management and Handling) Rules, 2011 are based on the extended producer responsibility concept and promote GHG emission reduction through proper handling and recycling of electronic waste. Specific sector-level recommendations have been formulated under the NMSH, for integration into relevant city's and/or state's regulations and bye-laws to enable improvements in service delivery and address climate change concerns.





Table 10 Sector-wise Institutional Network in India for National Communication

Sector	Human Resource Capacity (Number of expert institutions involved)				Technological Capacity ⁵				Supporting Policies and Processes			
					Measuring		N ₂ O Emissions		Supporting policies with identified MRV mechanism	Measuring and Reporting		Type of verification
					CO ₂ Emissions	CH ₄ Emissions	Adopted Tier	Emission Factor category		Measuring and Reporting institutions	Measuring and Reporting Frequency	
Energy Sector	NATCOM 1 4	NATCOM 2 7	BUR 1 4	BUR 2 4	Tier Adopted T1, T2, T3	D, CS	T1	D	User Guide for CO ₂ Baseline, Adoption of clean coal technologies; Electrification of Railways; Dedicated Freight Corridors of Indian Railways; Aviation; Buildings Star Rating System; GRIHA; LEEDs; Domestic Efficient Lighting Program; Street Lighting National Program, S&L	CEA, BEE, CERC, Verification SERC, CPCB, SPCB	Annual monitoring and reporting	CEA Self-Verification
Industry (IPPU)	4	6	3	2	T1, T2	D, CS	T1	D	Perform Achieve and Trade – I, II III, IV; Zero Defect Zero Effect	BEE, DCs (Industries), DIPPP, MSME, QCI	Regularly - Based on Certification	Empanelled Energy Auditor Third Party Verification
Forestry (LULCF)	2	16	3	2	T2	CS	T2	CS	Afforestation; Twenty Point Programme, activities under REDD+	FSI, CAMPA,	Annual monitoring and reporting	FSI, CAMPA, CAG Self-Verification and Third Party Verification

⁵ As per BUR2, T1 - Tier 1; T2- Tier 2; T3- Tier 3; CS- Country Specific; D- IPCC Default

Table 10 Sector-wise Institutional Network in India for National Communication

Sector	Human Resource Capacity (Number of expert institutions involved)				Technological Capacity ⁵						Supporting Policies and Processes									
					Measuring			Emission Factor Category			Supporting policies with identified MRV mechanism		Measuring and Reporting		Verification					
					CO ₂ Emissions	CH ₄ Emissions	N ₂ O Emissions	Adopted	Emission Factor Category	Tier			Adopted	Emission Factor Category	Measuring and Reporting institutions	Measuring and Reporting Frequency	Verification institutions	Type of verification		
Agriculture	NATCOM 1	NATCOM 2	BUR 1	BUR 2	Adopted	Emission Factor Category	Tier	Adopted	Emission Factor Category	Tier	Adopted	System of Rice Intensification (SRI), Crop Diversification, Cool Farm Tool model	DAHDF, DACFW, DARE	Annual monitoring and reporting	Department of Agriculture Cooperation & Farmers Welfare	Self-verification				
Waste	1	2	2	1	-	-		T1, T2	D, CS	T1, T2	D, CS	Solid Waste Management Programmes, Waste Water Recycling and Waste to Energy	MoEFCC, CPCB, SPCBs, PCCs	Annual monitoring and reporting	CPCB	Self-verification				



3.3 Moving towards a streamlined domestic MRV system

Creation of a system to measure, report and verify (MRV) actions and commitments of the Parties has been placed as the most crucial component during the international climate negotiations. India, being a party to the UNFCCC, is now required to submit a Biennial Transparency Report (BTR) in 2024 which offers less flexibility as is allowed in the Biennial Update Reports (BUR). India submitted its second BUR in December 2018 which was largely based on a hybrid approach involving both the 1996 IPCC guidelines and the 2006 IPCC guidelines for GHG emission estimations. Going further, from 2024, India would require to abide by the draft decision on MPGs of ETF as discussed at COP24 and report its GHG emissions using the IPCC 2006 guidelines with data no less than three years in arrears.

The preceding institutional readiness analysis demonstrated that India's lack of stable and permanent institutional arrangements at the national level is one of the biggest barriers towards progressive reporting often resulting in data gaps across all five sectors. This was also reflected in India's second BUR as a big constraint across all sectors. These data gaps can be broadly classified into two categories: first is the lack of availability of data; and second is availability of data that is inconsistent or not sourced properly. In addition, absences of institutional capacities to develop country-specific emission factors and to perform uncertainty assessments represent big roadblocks in the process.

The sectoral challenges mentioned in the previous sections reflect towards the need for more focussed efforts to enhance the individual and institutional capacity for better data collection in preparing future national communications in India and addressing the data gaps. This can be done through a systematic integration between the MOEF&CC and other relevant ministries and institutions for better coordination on quality, and the availability of activity data. It is also absolutely necessary to have a National Inventory Management System (NIMS) that functions as a platform for documenting, archiving and updating database for each sector relevant to national communications.

Further, various policies and schemes at the national level have embedded parameters such as the financial and physical that help India report on many sectors. In

addition, India has well-established measurement and evaluation systems at central and state levels; such as for enhancing energy efficiency - the PAT and other demand side management programmes; for renewable energy - the RPOs and Renewable Energy Certificates; for projects under the Clean Development Mechanism (CDM) and the National Action Plan on Climate Change (NAPCC). Although most existing Measurement, Reporting and Verification (MRV) systems do not directly track GHG emissions and mitigation impact, existing reporting is useful in arriving at reasonable estimates of the impact of policies. However, a little modification in the existing data collection and reporting systems can help addressing data gaps and moving up the tier ladder. To give an example, the Annual Survey of Industries (ASI) which is one of India's largest, and the most comprehensive survey system established by the Ministry of Statistics and Programme Implementation (MOSPI) for the IPPU sector. A few revisions in the ASI methodology and subsequent assimilation of its information in inventory calculations could help in moving up the tier ladder for IPPU sector. Similarly, slight modification in calculations for PAT scheme so as to translate energy savings into tonnes of carbon dioxide equivalent and vice versa, could ensure the long-term sustainability of the scheme and enhance reporting mechanism within the IPPU sector. Alternatively, annual reporting by each State Pollution Control Board (SPCB), Pollution Control Committees and those under the various National Missions need to be strengthened and expanded to also include information in single metric that better conform to accurate GHG emission estimation in all sectors. It is also prudent to tap into the knowledge-base and networks of technical institutes and associations. Involving them could leverage development of technical guidance and resources for standardization and conversion of metrics for the diverse activity data.

Further, key institution such as the Prime Minister Council on Climate Change and the Indian Network on Climate Change Assessment (INCCA) could be revived. INCCA, launched in 2010 with nearly 120 institutions and 220 scientists could bring in the needed human capacity for reporting under the ETF.

The initiation of national MRV of GHGs and mitigation also triggered the private sector to action such as the creation of civil society platform that provides data on GHGs emissions for various sectors and there also exist various private sector lead initiatives that measure GHGs emissions that contribute to the national GHGs inventory.



Therefore, it is imperative that these efforts are streamlined through data management systems (such as the NIMS), technical capacity, improved analytical capabilities, and most importantly, active coordination between all stakeholders and the various nodal agencies within the government.

Besides, over the last decade, many multi-stakeholder transparency-related initiatives have come to force globally with an aim to strengthen technical, institutional and financial capacities and capabilities of Parties and non-Party stakeholders such as Many multi-stakeholder transparency-related initiatives such as the Partnership on Transparency in the Paris Agreement (PATPA) for practical exchange and policy dialogue between countries on enhanced climate transparency, Capacity-building Initiative for Transparency (CBIT) to support the development of transparency frameworks and domestic MRV systems, Initiative for Climate Action Transparency (ICAT) to promote the use of a common voluntary framework to

assess the impacts of countries' policies and actions and many more. These transparency initiatives however, differ in terms of their scope, type of activities, geographical coverage, and other factors reflecting innovation and diversity. However, many of these often remain in their own silos reflecting to the need for developing important cross-cutting strategies and networks that can enable for their interactions to maximize the impact on participating stakeholders. Despite these initiatives being in place, most developing countries (including India) are yet to build a robust sustainable institutional mechanism to regularly communicate, share, and review their efforts to reduce GHG emissions. This reflects to the need to deepen the understanding of whether these initiatives are enough to build the needed institutional capacities for all stakeholders to act in accordance with the requirements set under ETF.

Some key global initiatives, their relevance to ETF and impacts in India are mapped in table 11 and table 12.



Table 11: Transparency-Related Support Initiatives:

S.no.	Initiative	Description	Relevance to Enhanced Transparency Framework of the Paris Agreement	Linkage/Impact in India
1.	Partnership on Transparency in the Paris Agreement (PATPA) https://www.transparency-partnership.net/	<p>PATPA was established in 2016 to promote support for practical exchange and policy dialogue between countries on enhanced climate transparency (PATPA). This initiative built on the earlier 2010 international partnership on mitigation and MRV between Germany, South Africa, and South Korea. PATPA expanded its scope to cover the transparency not only of mitigation actions, but also of adaptation and support. More than 100 countries participate in PATPA activities, together with numerous agencies, research organizations, and other international initiatives (PATPA).</p> <p>Participating Regions/Countries: Africa, Asia & Pacific and Latin America & Caribbean</p>	Enhancing capacity for mitigation, adaptation and support actions through practical exchange and policy dialogue between countries on enhanced climate transparency	None
2.	NDC Partnership http://ndcpartnership.org/	<p>Through our Partnership, members leverage their resources and expertise to provide countries with the tools they need to implement their NDCs and combat climate change to build a better future.</p> <p>Participating Regions/Countries: Global</p>	Enhanced capacity for tracking progress on NDC targets	India, being a member country to the NDC partnership, the initiative helps in leveraging resources and expertise for implementing and tracking progress on NDCs, a key requirement under ETF

Table 11 Cont...

S.no.	Initiative	Description	Relevance to Enhanced Transparency Framework of the Paris Agreement	Linkage/Impact in India
3.	WRI's Tracking and Strengthening Climate Action (TASCA) https://www.wri.org/ourwork/project/trackng-and-strengthening-climate-action	Provides governments with the tools and resources they need to track the implementation and effects of their NDCs and the underlying policies that support them. Participating Regions/Countries: Colombia, Ethiopia, India, Indonesia, and South Africa	Enhanced capacity for Reporting and Monitoring of GHG inventories	The initiative aided in sector-specific research and development of mitigation tools to enhance national and climate planning and implementation.
4.	Information Matters https://www.giz.de/en/worldwide/30164.html	Information Matters is a project of GIZ, Germany's international development agency. The project aims to support countries in preparing their transparency reports under the Convention. It does so through approaches specific to developing countries in close consultation with country stakeholders and through national workshops, which bring together country and international experts (GIZ) Participating Regions/Countries: Chile, Dominican Republic, Georgia, Ghana, Colombia, Philippines, and Vietnam. Project phase III (2018-2019): Ad-hoc Facility for African countries, Least Developed Countries (LDCs), Small Island Developing States (SIDSs) and other developing countries.	Enhancing Capacity for Reporting: Together with local partners, the initiative analyses the existing reporting system and the relevant institutional structures. The initiative consults closely with all stakeholders to produce a plan that is adapted to the respective conditions and circumstances in each country in order to establish a transparent, sustainable and informative reporting system.	None

Table 11 Cont...



S.no.	Initiative	Description	Relevance to Enhanced Transparency Framework of the Paris Agreement	Linkage/Impact in India
5.	Initiative for Climate Action Transparency (ICAT) https://climateactiontransparency.org/	<p>ICAT was established in 2016 to promote the use of a common voluntary framework to assess the impacts of countries' policies and actions, report progress, and foster greater transparency, effectiveness, and ambition (ICAT 2016). The initiative relies on the development of guidance and capacity-building activities to improve the availability and quality of data and enable countries to promote efficient and cost-effective policies. In addition to developing guidance, ICAT integrates capacity-building activities and knowledge-sharing to engage countries in the use of a common framework.</p> <p>Participating Regions: South America, Africa and Asia</p>	Enhancing Capacity for Reporting at Policy level: ICAT integrates methodological work, capacity building and knowledge sharing to strengthen the transparency and effectiveness of climate policies and actions though developing an integrated suite of globally applicable methodologies and tools.	In India, work under ICAT is scoped towards streaming and enhancing transparency covering both adaptation and mitigation policies in the following key sectors: Renewable energy, Buildings, Transport.
6.	Partnership for Market Readiness (PMR) https://www.thepmr.org/	<p>The PMR rallies countries, organizations, and experts to explore and identify innovative approaches to GHG mitigation using markets and carbon pricing, including the underlying MRV system. An MRV work stream focuses on developing guidance for implementing and designing MRV systems that can support carbon-pricing efforts (PMR 2016).</p> <p>Participating Countries: Argentina, Brazil, Chile, China, Colombia, Costa Rica, India, Indonesia, Jordan, Mexico, Morocco, Peru, South Africa, Sri Lanka, Thailand, Tunisia, Turkey, Ukraine and Vietnam.</p>	Enhanced capacity for Reporting and Monitoring: Bridging knowledge gaps and needs related to the domestic MRV frameworks thereby enhancing reporting and monitoring capacities are within purview of this initiative.	The PMR supports India to build a centralized GHG data management system that can support various market-based instruments (MBIs) that could be integrated with the national GHG inventory.

Table 11 Cont...



S.no.	Initiative	Description	Relevance to Enhanced Transparency Framework of the Paris Agreement	Linkage/Impact in India
7.	Research collaborative led by the Organisation for Economic Co-operation and Development (OECD) to track private climate finance http://www.oecd.org/finance/tracking-climate-finance.htm	<p>The OECD research collaborative brings governments, research institutions, and international finance institutions to partner and share best available data, expertise, and information to advance policy-relevant research on tracking private climate finance in a comprehensive and timely manner.</p> <p>Participating Countries: Australia, Austria, Belgium, Canada, Denmark, European Commission, Finland, France, Nordic, Switzerland, United Kingdom, United States</p>	Enhanced capacity for Reporting and Monitoring : This work aims to contribute to the design of international guidance for the tracking and transparency of support (OECD 2018).	None
8.	Capacity-building Initiative for Transparency (CBIT) https://www.thegef.org/topics/capacity-building-initiative-transparency-cbit	<p>The Capacity Building Initiative for Transparency (CBIT) is a one-off opportunity to support the development of transparency frameworks and domestic MRV systems. These GEF funds can be used to help the establishment of new institutional arrangements and adapt existing organisational structures, relationships and mandates. This can help to form a functioning sustainable 'system' to gather, compile, check, and report and re-use climate action related data in the countries. CBIT will enable capacity building of appropriate teams of people to take ownership of the technical (data collection, compilation, reporting) and non-technical (stakeholder engagement, resourcing and management and coordination) aspects of the MRV system long-term. It will also provide the opportunity to develop country specific guidance and tools that will improve stakeholder engagement, support data flows, help to continuously improve and facilitate the long-term sustainability of the system and make valued input into national decision-making processes.</p> <p>Participating Countries/Regions: Global</p>	Enhancing Capacity Building for ETF: CBIT projects build on existing transparency arrangements, as well as on country efforts to develop National Communications, Biennial Update Reports, and other international greenhouse gas (GHG) assessment and review processes.	Under the initiative, India has been allocated with Rs. 609 core to implement climate transparency related projects domestically.

Table 11 Cont...



S.no.	Initiative	Description	Relevance to Enhanced Transparency Framework of the Paris Agreement	Linkage/Impact in India
9.	Climate Transparency https://www.climate-transparency.org/about	Climate Transparency is a global partnership with a shared mission to stimulate a 'race to the top' in G20 climate action and to shift investments towards zero carbon technologies through enhanced transparency. Participating Countries: All G20 countries	Enhanced capacity for Reporting and Monitoring	Under this initiative, India prepared a report compiling information on Greenhouse Gas (GHG) Emissions Development, Decarbonisation, and Climate Policy and Financing the Transition.
10.	Measurement and Performance Tracking in Developing Countries (MAPT) https://www.wri.org/our-work/project/measurement-and-performance-tracking-developing-countries	MAPT, a WRI initiative, is a six year project (2011-2016) conducted with governmental and non-governmental partners. MAPT intended to build the capacity of developing countries to effectively track progress toward meeting domestic climate, energy, and development goals. Participating Countries: Colombia, Ethiopia, India, South Africa, and Thailand (Thailand only in Phase I)	Enhanced capacity for Reporting and Monitoring	
11.	Caribbean Cooperative MRV Hub	A unique collaborative technical institution where countries in the region can share expertise to foster regional excellence and generate stronger policy-relevant carbon accounting. The MRV Hub provides a mechanism through which country experts will function as a true learning, mentoring and resource-sharing technical cooperative Participating Regions: Caribbean region	Enhanced capacity for Reporting and Monitoring	None

Table 11 Cont...



Table 12: Non-Party Transparency-Related Support Initiatives

S.no	Initiative	Nature/ Geographical coverage	Description	Relevance to Enhanced Transparency Framework of The Paris Agreement	Linkage/ Impact in India
1.	India GHG platform http://www.ghgplatform-india.org/	India	The GHG Platform – India is a collective civil-society initiative providing an independent estimation and analysis of India's greenhouse gas (GHG) emissions across key sectors such as energy, waste, industry, agriculture, livestock, forestry, and land-use and land-use change sectors. The platform includes notable institutions such as CEEW, C-STEP, ICLEI SA, Vasudha Foundation, and WRI India in addition to a few sectoral experts in their individual capacity. The platform was jointly conceptualised by Shakti Sustainable Energy Foundation and Vasudha Foundation. The Vasudha Foundation also acts as the Secretariat of the Platform.	Enhancing Capacity for reporting on GHG inventories: The platform provides sub-national GHG emission estimates and also strives to expand the time-series for the national estimates that will aid in enhancing capacity for reporting.	The platform enables streamlining of domestic inventory by filling Data Gaps and Enhancing Data Accessibility. The platform also feeds Policy Dialogue and is enabling creation of a repository of information in one accessible data base for use by all ministries.
2.	Climate Disclosure Project (CDP) https://www.cdp.net/en	Global	CDP aims at encouraging companies, cities, states and regions to measure and manage their environmental impacts.	Mainstreaming transparency	Through this initiative, a database of self-reported environmental data is being created that is invaluable for cities, companies and investors to report thereby increasing overall transparency of the system.

Table 12 Cont...



S.no	Initiative	Nature/ Geographical coverage	Description	Relevance to Enhanced Transparency Framework of The Paris Agreement	Linkage/ Impact in India
3.	We Mean Business collation https://www.wemeanbusinesscoalition.org/	Global	We mean business is working with world's most influential businesses to take action on climate change. The collation encourages governments to create enabling policies that support companies to deliver bold climate action at scale. This includes identifying key policy priorities for development and interpreting their impact for business. This also involves understanding companies GHG emissions and its impacts. Initiatives such as RE100 (100% renewable power), EP100 (Commit to smart energy use), EV100 (Commit to electric vehicles), etc., are a part of this collation which aims at ratcheting global climate action.	Mainstreaming transparency through its various initiatives by helping companies understand its GHG emission profile and also by enabling transition to a holistic zero-carbon economy.	44 companies in India are a part of this collation involved in multiple initiatives such as RE100, Science Based Targets initiative, LCTPi, EP100, Ev100 etc. Being a part of these initiatives, enable countries to better understand transparency within climate action and also enables transition to a holistic zero-carbon economy.
4.	Under2 Coalition project https://www.theclimategroup.org/project/under2-coalition	Mexico (Baja California, Jalisco and Yucatán), India (Chhattisgarh and Telangana), Brazil (Pernambuco) and South Africa (KwaZulu-Natal)	Under2 Coalition project – which is part of the International Climate Initiative (IKI), in partnership with Ricardo Energy and Environment, ICLEI Local Governments for Sustainability, Greenhouse Gas Management Institute and CDP – aims to support regions to deliver on their Under2 commitment of limiting greenhouse gas emissions to 2 tonnes per capita or 80%–95% below 1990 by 2050, by advancing their monitoring, reporting and verification (MRV) capacity.	Mainstreaming transparency: supporting governments so they have the expertise and systems in place to assess their emissions accurately, track progress and ensure policies remain fit for delivering against climate targets. This improves climate transparency, which is critical to reaching the Paris Agreement goals.	This initiative includes project to assist governments from emerging economy regions to develop robust greenhouse gas inventories by advancing monitoring, reporting and verification (MRV) capacity.

Table 12 Cont...



S.no	Initiative	Nature/ Geographical coverage	Description	Relevance to Enhanced Transparency Framework of The Paris Agreement	Linkage/ Impact in India
5.	Greenhouse Gas Protocol http://ghgprotocol.org/ country-programs	Mexico, China, India, Brazil and the Philippines	Greenhouse Gas Protocol aims at developing country specific GHG standards and tools and pursues country specific capacity building. This initiative is a crucial platform to measure, and therefore manages, greenhouse gas emissions in partner countries.	Mainstreaming transparency: Greenhouse Gas Protocol works with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programmes for tackling climate change.	Under this initiative, India developed its first platform on GHG involving companies. The program aimed to help companies in India to monitor their progress towards voluntary reduction goals in a consistent and credible manner. It provided the companies with tools and technical assistance to build inventories, identify reduction opportunities, establish both annual and long-term reduction goals and track their progress based on the GHG Protocol.
6.	Japan Keidanren's GHG Accounting and Reporting system http://iepd.iipnetwork.org/policy/keidanren-voluntary-action-plan-vap-ended	Voluntary	Encourage disclosure of emissions (GHG emission inventory), reduction target, and disclosure of reduced emissions by companies in Japan.	Mainstreaming transparency	None

Table 12 Cont...



S.no	Initiative	Nature/ Geographical coverage	Description	Relevance to Enhanced Transparency Framework of The Paris Agreement	Linkage/ Impact in India
7.	The Climate Registry https://www.theclimateregistry.org/	North America and Canada	The initiative is specifically aimed at improving measuring, reporting and verification of GHG emissions of companies in North America and Canada by providing tools and services that can be customized to the company's needs.	Mainstreaming transparency by specifically focusing on measuring, reporting and verification of company's GHGs. The initiative helps in identifying GHG reductions, building stakeholder trust, demonstrating leadership and accountability among companies, along with encouraging them to disclose decisions and programs taken up to combat climate change.	None
8.	Japan GHG Accounting and Reporting System http://iepd.ippnetwork.org/policy/mandatory-ghg-emissions-reporting	Mandatory in Japan	Introduced in 2005, mandating companies (with >3,000 tCO ₂ e annual emission) to calculate their GHG emissions and report the results to the Government.	Mainstreaming transparency	None
9.	South Africa National Atmospheric emissions inventory system (SAAELIP) https://saaelip.environment.gov.za/SAAELIP/home/	Mandatory in South Africa	SAAELIP is an online portal for the management of Atmospheric Emission Licences (AEL) as well as the estimation and reporting of atmospheric emission inventories terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). SAAELIP provides a seamless integration between the management of Atmospheric Emission Licences and the reporting of atmospheric emissions into the National Atmospheric Emission Inventory System (NAEIS).	Mainstreaming transparency	None



4. CONCLUSIONS

This paper has presented a deep analysis into India's sectoral institutional framework that is followed for reporting national communications to the UNFCCC. The objective was to unpack the MPGs as adopted at COP24, and understand its implications and thereby assess the readiness of the domestic institutional structure to meet the new requirements set under ETF. Ultimately, such an assessment can provide a guide to the existing institutional arrangements, to the extent that the drivers identified are to be seen in unison and as part of a greater structural process, and not in silos. The following paragraphs offer some concluding reflections on the bigger picture that emerges from the analysis presented above, and on future directions for enhancing reporting under ETF in India.

- We are on a path towards enhancing transparency in the international climate regime:** While international negotiations on post-2020 climate regime are underway, the role of MRV in enhancing transparency of climate actions will remain as the most anticipated component of the Paris Agreement bridging various negotiation areas. MPGs on ETF adopted at COP24 do provide better guidance; Parties now have more detailed and concrete guides for reporting their climate action. Over time, reports under the ETF should deliver better information on climate action and support. The MPGs on transparency agreed provide detailed reporting guidance for Parties on BTRs to be prepared by all Parties under the Paris Agreement. Discussions during SBSTA 50 (June, 2019) further developed the Common Reporting Tables (CRTs) for reporting of the national greenhouse gas (GHG) inventories and Common Tabular Formats (CTFs) for a number of other areas, including information necessary to track progress towards NDCs under Article 4 (UNFCCC, 2018). However, there are a few points in dispute that revolve around the scope of flexibility for developing countries. Current negotiation text, does not define how, where or under which format Parties are to communicate and how they are applying flexibility in preparing their inventories. Further, a concrete structure of the biennial transparency report is yet to be deeply discussed, involvement of expert on some level will be necessary.

However, further deliberations are required on the issues of how any data gaps could be best depicted in CRTs, so that a distinction can be made between data missing due to the use of flexibility and data missing due to other reasons, such as those addressed by the IPCC notation keys. Another important item for deliberation on ETF is to consider the diversity of NDC typology, in developing the CRFs. It is important to strike a balance between the conditionality of targets and the information Parties are to provide in tracking progress towards achieving their NDCs.

- Dilution of flexibility brings some new and emerging challenges for developing Parties:** The MPGs set under the ETF resulted in a reduced degree of flexibility for developing Parties to account and report on their climate action. Starting 2024, all Parties are now to submit BTR and report their GHG emissions as per the IPCC 2006 guidelines using CRTs and CRF. Developing parties are now encouraged to report on least three GHGs (CO₂, CH₄ and N₂O) and four IPCC sectors—Energy sector, Industry Process and Product Use (IPPU) sector, Agriculture, Forestry and other Land Use (AFOLU) sector and Waste sector—providing detailed information on GHG sources and sinks, this was earlier done on their discretion. Certainly, this dilution of flexibility calls for more work from developing Parties, in terms of building adequate reporting capacities. But, as perhaps goes without saying, rising to the challenge of complying with requirements under ETF, would require an investment of resources and commitment by many developing Parties. This also implies to the opportunity and time for developing Parties to enhance and build on their domestic MRV mechanisms so as to report better under the framework. To this end, inclusive and extensive domestic stakeholder engagement is absolutely essential for conducting self-assessment and thereon building a robust framework. An integrated MRV system for GHG mitigation requires streamlined data management systems, technical capacity, improved analytical capabilities, and most importantly, active coordination amongst all the stakeholders and the



various nodal agencies within the government for GHG mitigation across regions, sectors and time. Further, to develop specific (consolidated) monitoring and verification process for GHG inventory and mitigation actions in any developing Party, additional finance and capacity building would be required. Furthermore, support needs to be targeted at reducing data gaps in national statistics relevant to climate change reporting, which is a common problem in many developing countries, and at enhancing basic information, such as the energy balance, livestock numbers, vehicle stock or waste management practices. This will require working with other ministries and agencies aside from the national UNFCCC focal point (usually the Ministry of Environment). In most advanced developing countries, support needs to be provided in order to better understand the use of modeling tools that make it possible to track the progress of mitigation actions and that also aim to encompass enhancements in sectors that are traditionally neglected, such as waste, etc.

- **India's transparency journey thus far, represents challenges and gaps in capacities relating to human resources, technology and requires alignment with supporting policies and processes:** International agreements on the ETF reflects an urgent need to address domestic challenges around monitoring and reporting of GHG data in order to enhance international reporting and the review process. India's current national communications are based on a hybrid approach which involves both the 1996 IPCC guidelines and the 2006 IPCC guidelines. Going further, from 2024, India would require reporting its GHG emissions following the IPCC 2006 guidelines. As per the 2006 guidelines, it is important to build capacity of institutions within sectors such as cement, transport, agriculture and LULUCF etc. to meet the different data requirements. Furthermore, the current administrative levels in the key institutional bodies, such as the MOEF&CC and project management cell, indicate low human resource capacity. In addition, there is a lack of permanent institutional body for coordination which often results in data gaps.

The effort now should be focused towards building a streamlined institutional network with a central designated body, backed by a legal mandate to coordinate with ministries and expert institutions in all sectors. The scope of improvement with reference to the inventories presented in NATCOMs and BURs

should be towards organizing and building archival system for the relevant data; developing country-specific emission factors along with refinement of the existing GHG emission factors; and building capacities for extending inclusion of additional gases to the extent capacities permit.

- **What could be the starting points to build a robust domestic MRV institutional framework to meet the requirements under ETF?** Like many other developing countries, India is yet to streamline its domestic MRV system. So far, multiple efforts have been made to build MRV for the specific sectors, actions and programmes but not for GHG mitigation directly. MRV is currently scattered and varies with respect to policy, action and sector. This results in a strong need to integrate all these individual actions into one common platform so as to address challenges such as transaction cost, time, etc. It is then important to strengthen and streamline capacities and capabilities of relevant national institutions (including central, state, district, research institutions, civil societies, etc.) with national priorities, and bring in suitable mechanisms backed by legal mandates that ensure the improvement of transparency over time. Indian climate institutions should follow a facilitative approach that complements existing institutions to promote mainstreaming of transparency considerations in a manner consistent with development. This implies nudging and provoking existing sectoral bodies to seek co-benefits opportunities in reporting on mitigation actions and mainstream climate transparency into development decisions. Within the purview of international reporting, a number of starting points can be identified from this analysis:

- ♦ **Building on current MRV mechanisms and lessons from the past:** A lot can be achieved with what India already has such as the various individual MRV initiatives in different sectors. Lessons of the past suggest that a complementary high-level strategy group such as the Prime Minister's Council on Climate Change and the INCCA group that can serve a coordinating role and an accountability function for other climate institutions is necessary. Given the capacity shortfalls in the government, the ability to draw in academics, civil society representatives and others with expertise to complement governmental capacity would be very helpful. In architectural



terms, having institutional structures at multiple levels—centre, states and cities—would reflect the increasingly multilevel governance nature resulting in enhanced transparency. Further, efforts have been undertaken to increase expertise sharing through frequent interactions between researchers of different institutions. The laboratories have also been equipped better to carry out research activities. However, requirement for more focused efforts to enhance the individual and institutional capacity exist for timely data collection in future national communications.

♦ **National Inventory Management System (NIMS):**

The need for NIMS that will function as a center for documenting, archiving and updating databases required for national communications has been highlighted in recent years. Such a system will serve as a transparent approach for the preparation of BTRs. The envisioned NIMS will be a dynamic system that also allows easy editing and revision of methodology, data and emission factors with respect to the IPCC 2006 guidelines. The NIMS will bring immense benefits in the spheres of managing, archiving and viewing data. Steps taken towards setting up an NIMS system involve bridging current gaps in the inventory, collating activity data from various ministries and departments, conducting regular surveys to exact data gaps, performing

regular QA/QC checks, developing emission factors for key sectors, analyzing and reducing uncertainty sources and regularly ensuring a third-party review estimating the inventory to ensure reliable inventory process. The envisioned NIMS will archive, update and produce information leading to GHG emissions/removals sorted by the sector at national/state/district and point source resolution.

- ♦ **Transparency-related support initiatives:** India could leverage its institutional capacities through multiple transparency-related support initiatives around the globe. These initiatives could help in enhancing capacities of both governments and private and civil society bodies.

In conclusion, the GHG inventory in India has seen significant improvements between 1996 and 2018. However, there exists a need to continue updating methodology for sectoral GHG inventory, particularly to meet the new and additional requirements set in 2006 IPCC guidelines. Further, updating methodology will reduce uncertainty in GHG estimates particularly for sectors such as LULUCF and agriculture where uncertainty is already high. This translates to the urgent need for substantial financial, infrastructure upgradation and capacity building-related support by India to ride the tier ladder and meet the enhanced reporting requirements under the Convention and Paris Agreement. Thus, the support provided should be new, additional and climate specific.



ABBREVIATIONS

APA	Ad Hoc Working Group on the Paris Agreement
ASI	Annual Survey of Industries
BEE	Bureau of Energy Efficiency
BR	Biennial Report
BTR	Biennial Transparency Report
BUR	Biennial Update Report
BUR	Biennial Update Report
CEA	Central Electricity Authority
CH₄	Methane
CMA	Cement Manufacturer's Association
CO₂	Carbon Dioxide
CO₂ eq.	Carbon Dioxide Equivalent
COD	Chemical Oxygen Demand
COP	Conference of Parties
CPCB	Central Pollution Control Board
CRFs	Common Reporting Formats
CRRI	Central Road Research Institute
CS	Country-specific Emission Factor
CTR	Common Tabular Formats
D	Default Emission Factor
EF	Emission Factor
ETF	Enhance Transparency Framework
Gg	Gigagram
GHG	Green House Gases
IAR	International Assessment and Review
ICA	International Consultation Assessment
INC	Initial National Communication on Climate Change
INCCA	Indian Network on Climate Change Assessment
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LDCs	Least Developed Countries
LULUCF	Land Use, Land-Use Change and Forestry
M&E	Monitoring and Evaluation
MA	Multilateral Assessment

MCL	Mahanadi Coalfields Limited
MPGs	Modalities, Procedures and Guidelines
MRV	Measurement, Reporting and Verification
MSME	Micro, Small and Medium Enterprise
MSW	Municipal Solid Waste
Mt	Million tonnes
N₂O	Nitrous oxide
NATCOM	National Communication on Climate Change
NCV	Net Calorific Value
NDCs	Nationally Determined Contributions
NEERI	National Environmental Engineering Research Institute
NIMS	National Inventory Management System
NSSO	National Sample Survey Office
PA	Paris Agreement
SBSTA	Subsidiary Body for Scientific and Technological Advice
SF₆	Sulfur hexafluoride
SIDS	Small Island Developing States
SPCB	State Pollution Control Board
ULB	Urban Local Body
UNFCCC	United Nations Framework Convention on Climate Change



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Published by:

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New Delhi - 110 003, INDIA

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